AT the sixty-third annual meeting of the American Pharmaceutical Association, which was held in San Francisco during the week of June 9, the president of the association, Mr. Caswell A. Mayo, of New York, announced that Mr. Samuel W. Fairchild had agreed to provide funds for a scholarship in pharmacy paying $300 annually, to be awarded to an undergraduate student by a commission composed of the presidents of the American Pharmaceutical Association, the American Conference of Pharmaceutical Faculties, the National Association of Boards of Pharmacy, and the editor of the *Journal of the American Pharmaceutical Association.*

Two new foundations are announced at Leeds University—the William Walker scholarship, of the annual value of £90, for the scientific study of leather with a view to its subsequent application to industrial development, and the William Walker Exhibition, for instruction in the technology of coal and its by-products. The new endowments are founded in memory of the late Mr. William Walker, of Whitehaven, by his widow and his sons, Mr. Herbert W. Walker and Mr. Arthur Walker. Both are primarily tenable at Leeds by inhabitants of the Whitehaven and Bootle districts, and the donors have placed £4,500 in trust for the purpose.

PROFESSOR IVEY F. LEWIS, of the University of Missouri, has become Miller professor of biology and head of the school of biology at the University of Virginia.

AT the Montana State College, R. H. Bogue, formerly at the Massachusetts Agricultural College, has been appointed assistant professor of chemistry and geology; Henry M. Shea, formerly of the South Dakota State College, analyst of the food and drug laboratory, and H. B. Foote, formerly of Oklahoma, instructor in botany.

DR. PAUL H. DIKE has been appointed professor of physics in Robert College, Constantinople, to succeed Professor Manning, who died last year. He sailed on the Greek line to Piraeus on September 15 with his family, together with a number of the members of the faculty of Robert College. The college is to open in spite of the war, and it is hoped that the party will be able to get through without much delay. The women and children will await developments in Athens.

DISCUSSION AND CORRESPONDENCE

THE LAWS OF MOTION

How well some of us remember and how much some of us have heard of the days of Thomson and Tait, and how satisfied we were and are with what Thomson and Tait had to say on this subject! In those days scarcely any one understood the laws of motion, but nowadays, thanks largely to the influence of Thomson and Tait, the chief confusion is that which rises from slightly different points of view, mostly correct; and the laws of motion now constitute the topic in the discussion of which one pays the least attention to what others say, and quite properly so.

We do, however, believe that it is misleading to speak of *the* fundamental equation of dynamics. Given three bodies A, B and C, and three identifiable forces a, b and c. Let the acceleration of each body due to each force be observed, and let the results be as shown in the accompanying table.

TABLE OF OBSERVED ACCELERATIONS

		Bodies		
		A	B	C
Forces	a	25	30	35
	b	50	60	70
	c	75	90	105

The acceleration varies from body to body for a given force, and from force to force for a given body. These are two equally fundamental modes of variation, and corresponding to them we have two equally fundamental laws of variation; and these laws of variation are entirely independent of the measurement of force and mass. Let us suppose that the above table has been extended so as to include a great many different forces and a great many different bodies, then a careful inspection of

the table would lead to the following generalizations.

(*a*) If one force produces twice as much acceleration as another force when acting on a given body, then the one force produces twice as much acceleration as the other force when acting on any body whatever.

(*b*) If one body is accelerated twice as much as another body under the action of a given force, then the one body is accelerated twice as much as the other body under the action of any force whatever.

The experimental fact (*a*) makes it convenient to define the ratio of two forces as the ratio of the accelerations they produce when acting on a given body, because this ratio is the same for all bodies.

The experimental fact (*b*) makes it convenient to define the ratio of the masses of two bodies as the inverse ratio of the accelerations produced by a given force, because this ratio is the same for all forces.

MEASUREMENT VERSUS UNDERSTANDING

FORTY or fifty years ago, after the system of electric and magnetic measurements had been fully established, every physicist had come near to a belief which was voiced by Sir William Thomson when he said that "when you can measure a thing you know all about it," and this point of view reached its climax in the days when physicists almost without exception believed that all subsequent development in their science would be to add significant figures farther and farther to the right of the decimal point! This point of view has, however, been swept away by the discoveries of recent years, and yet its germ seems to cling to some of the older phases of natural philosophy, for it comes to life in nearly every one's mind when any of the long-established principles of physics are contemplated. This is illustrated by nearly everything that has been said of recent years concerning the laws of motion. The measurement of force and the measurement of mass seem to be mixed up inextricably with the experimental aspects of the laws of motion in nearly every one's mind, whereas, as it seems to us, the laws of motion appear in their simplest and most clearly intelligible form when forces and masses (bodies) are not measured but merely identified. Sir William Thomson's statement certainly represents an obsolete point of view, which no doubt Lord Kelvin would have admitted. You can know a lot about a thing even if you can't measure it, and if you can and *do* measure it under widely varying conditions you can find out a great deal more about it. But to be able to measure a thing is, in the last analysis, merely to have enough wit to read a clock, or a yard stick, or to use a balance.

Measurement versus understanding! It certainly does seem fair so to characterize the difference between the natural philosophy of forty years ago and the natural philosophy of to-day; and no one shows a keener insight into the changing point of view than Karl Pearson[1] when he insists that after all physics, like botany, is a descriptive science.

INERTIA AND MASS. THE ESSENCE OF MATHEMATICAL PHYSICS

THE inverse ratio of the accelerations produced in two bodies by a given force is spoken of above as the ratio of the masses of the two bodies. Let us speak of this as the *ratio of inertias,* and let us reserve the word *mass* to designate the result obtained by weighing a body on a balance. Then the quantitative identity of mass and inertia is a discovery, but it is by no means a discovery which should make us ashamed of the balance as an instrument of precision.

Let us retain as the fundamental meaning of the word mass *the result of weighing on a balance scale.* Indeed, the laboratory man would laugh at any one who pretended to do otherwise; beware of the laugh of the laboratory man, *he* can satisfy the man from Missouri!

Yes, but the ratio of inertias is a more absolute thing than the ratio of masses because the balance must be on earth! But is it? No one can imagine a celestial operation which would show the ratio of inertias of two lone bodies without a third body of some kind acting.

[1] See Pearson's "Grammar of Science."

Then why object to the earth as a third body? We, for our part, thank the Lord for the Earth! We are satisfied with it!

Yes, but the balance compares the forces with which the earth pulls on two bodies—the weights of the two bodies. Very true, but just here is involved the one thing above all others which makes physics a mathematical science, and it is a thing which many of our mathematicians seem to think least about, namely, the establishment of invariant one-to-one correspondences by experimental tests. Use a balance on a batch of sugar and you get always and everywhere the same numerical result,[1] use it on a part of the batch and you get a different result. This is the only condition that is necessary to justify the use of the result as a measure of quantity of sugar. The purely arithmetical condition that ten units of sugar break up into a batch of seven units, and a batch of three units might also seem to be a necessary condition, but it is not necessary, but only convenient, in that it leads to a simple system of sugar-arithmetic.[2]

We respect the experience of two thousand years in that we base our definition of mass on the use of the balance; and we look at the identity of inertia ratio and mass ratio as a discovery, but we refuse to depart from the point of view of men who buy flour and sugar by the pound. We are not ashamed of the balance!

We also respect the broader view of mathematics as the logic of fixed relations in our acceptance of experimentally established one-to-one correspondences as the essential basis of mathematical physics rather than the mere readings of numbers on sets of weights, and yard sticks and clock faces!

W. S. Franklin,
Barry MacNutt

[1] This statement is somewhat idealized for the sake of simplicity. If the use of the balance did always lead to invariant results, the rational theory of the balance would be of interest to the balance maker and to the speculative philosopher, but it would be of no consequence whatever to the experimental or mathematical physicist. As things stand, however, the rational theory of the balance is of importance in the elimination of what we call systematic errors, for under ordinary conditions the balance does not lead to invariant results. Many such cases arise in physics, and it is the common practise to keep clear of such complications in the earlier stages of the development of physical theory by framing definitions on the basis of ideal conditions.

[2] As an example of the kind of thing here referred to let us agree to measure "amperes" by the number of units of heat generated in a given wire per second. Then 3 "amperes" from one branch of a circuit joining with 2 "amperes" from another branch would give 11.9 "amperes" in the main circuit. In this system the arithmetical form of Kirchhoff's law would be as follows: The current in the main circuit is equal to the square of the sum of the square roots of the currents in the various branches of the circuit. Similarly sugar could be easily measured so that you would pay 5 cents for one unit, 7 cents for two units, 8.65 cents for three units, and so forth, without making the serious mistake of giving your sugar at a cheaper rate to the wealthy man who gets more than he needs than to the poor man who needs more than he gets. Figure it out for yourself.

POWDERY SCAB OF POTATOES IN OREGON

The occurrence of the *Spongospora* scab disease of potatoes in Tillamook County, Oregon, has recently come to the attention of the department of plant pathology of the Oregon Experiment Station, and since this important trouble has apparently not been reported west of the Rocky Mountains the record may be of general interest.[1]

The lot of potatoes in which the disease was first found was raised on a farm in the rather isolated coast district of Oregon referred to above. The owner stated that the seed of this variety had been introduced from twelve to fifteen years ago from an eastern state and that new seed had not been introduced on his farm since that time.

The diseased tubers first found came from a lot that had been shipped to the writer for experimental study, this particular lot being badly affected with an internal browning apparently of non-parasitic origin and with the

[1] Since the above was written a record of the appearance of this disease in Seattle on potatoes from British Columbia has been reported.